DOCUMENT RESUME

ED 249 942 IR 011 >84

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TITLE Decentralized Computing via Micros.
PUB DATE [May 84]
NOTE 10p.; Paper presented at the Mid-Year Meeting of the American Society for Information Science (Bloomington, IN, May 20-23, 1984).
PUB TYPE Viewpoints (120) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Attitudes; Case Studies; Centralization; *Computer Oriented Programs; *Decentralization; Higher Education; *Microcomputers; Networks; *Program Development; *Systems Development; *Technological Advancement
IDENTIFIERS *Computer Centers

ABSTRACT

A major factor in the amazing success of the microcomputer is its inherent ability to free the user from dependence on a large central computing facility with its attendant frustrations. Almost from the beginning, however, there has been pressure to integrate the micro with a more powerful host facility. There are both technical and political problems in such arrangements, including the resistance of the computer "establishment" to encroachment upon their domain by this small but potentially dangerous intruder. While it seems evident that the microcomputer will soon rival its larger progenitor in sheer computing power, thus fulfilling some systems managers' nightmares, the varying needs and capabilities of computer users will ensure the need for central computing facilities at least for the immediate future. Two case studies of microcomputer integration at Brown University and Carnegie Mellon, while still under development, provide solid evidence of serious efforts to integrate mainframe, mini, and microcomputers, while preserving the advantages of each. Six references are listed, as well as three sources that discuss the arguments for microcomputers versus big computers. (Author/LMM)

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DECENTRALIZED COMPUTING VIA MICRO'S

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ABSTRACT

A major factor in the amazing success of the microcomputer is its inherent ability to free the user from dependence on a large central computing facility with its attendant frustrations. Almost from the beginning, however, there has been pressure to integrate the micro with a more powerful host facility. This paper addresses the attendant problems, both technical and political, in such arrangements. Particular attention is given to the resistance of the computer "establishment" to encroachment upon their domain by this small but potentially dangerous intruder. While it seems evident that the micro will soon rival its larger progenitor in sheer computing power, thus fulfilling some systems managers' nightmares, it is concluded that the varying needs and capabilities of computer users will ensure the need for central computing facilities at least for the immediate future. Some consideration is given to the practicability and advisability of central computing organizations incorporating the micro function into their activities.

PRELIMINARY

My experience with micros is almost nil, with the exception of having been an interested observer since their first appearance, and also having fiddled around with those of friends and relatives. My library has a large bibliographic data base online with a DEC 11/70, and I have a terminal in my office where I keep track of acquisitions, do some word processing, and so forth. Just this month (January) we received our first micro, an IBM PC naturally! Since we have only just uncrated it, I hope to have an update on its utility for us at the meeting.

This is an especially interesting time for micro enthusiasts, with several interesting and innovative machines appearing on the market. As this is written, the computer community is abuzz about the new MacIntosh, Apple's latest entry, to debut in late January. Apple is also about to slash the price of the Lisa drastically. IBM's Peanut is also aborning, after four or five months of hoopla which played havoc with the stock market prices of its competitors. Riding the tsunami wave of success of the ubiquitous PC, Junior looks like a winner before it has

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even been "specced". Tandy Corporation already has its Model 2000 on its dealers' shelves - and, from a brief demo, I prognosticate that it will go a long way toward dispelling any "trash" image. In fact, it is the best mass market micro I've seen so far - by benchmark, it is almost twice as fast as the IBM PC, and comes with about 6 times as much storage onboard. Still, my DEC 11/70 will run circles around it when it comes to managing large files and accessing them promptly. Parenthetically, this is probably why I haven't bought a micro, although I expect to have done so by the time I present this paper, since I am always comparing them to the 11/70, and always to the disadvantage of the micro!

BACKGROUND

The implementation of our online library catalogue over a period of seven years has required that I work with several large-computer types, and the resulting friction and general dissatisfaction (prcbably both ways!) was the impetus to do a more formal study of end user problems, of which this paper is an outcome. By experiencing an abnormally large throughput of computer-type information (probably normal for an Engineering librarian!), plus personal contacts with fellow librarians, I reached the conclusion that my experiences were probably the rule rather than the exception.

Most of the computer professionals I came in contact with seemed to regard their expertise as some sort of educational annointing that set them apart from the common herd - for example, our system (as is typical) has scheduled maintenance activities when the system is down. I innocently asked our systems person just what type of maintenance was required - what I got was the condescending putdown "Oh, we just polish up the bits a bit!" Significantly, our sysops are endowed with superuser passwords, and dub themselves "wizards".

The point of this anecdote is <u>not</u> to point out what smug idiots the computer people are - indeed, I have the pleasure of knowing several who are extremely courteous and helpful. I could cite fully as many instances where <u>librarians</u> have been less than courteous and helpful to patrons. However, attitudes of the sort just described are an impelling force for users to seek to avoid these gratuitous insults.

LIBRARIES AND COMPUTERS

Libraries have much in common with computer establishments. Neither exists for its own benefit, but rather are service oriented organizations (or should be!). What I want to stress is the attitude of would-be users, both of computer systems and libraries. Go into any library, even a good one, and watch what a new patron typically does. He will prowl around, read the signs, thumb through the catalogue, sit down at a terminal and hack for awhile, and then, as a last resort, ask someone at the reference desk. I am not a psychologist, but there is apparently something that many of us consider demeaning in some way about asking for help, be it computer or library. One main difference between the two is that libraries, almost since their inception, have been geared to be self-using to some extent. That's why we have card or online catalogues, signs, classify the books according to the subject, and so forth. Computer systems typically haven't been this user-friendly however, although I see signs pointing in this direction. As another example, I recently blundered into a new screen editor with which I wasn't familiar, and nearly never got out of the thing! The usual exit and help commands didn't work, and it was somewhat equivalent to being lost in the Black Forest when one doesn't sprechen der Deutsch! True, there was a manual I could have bought telling me about its ins and outs, but in typical American fashion I never read directions until its too late.

Contrast this state of affairs to buying your own micro. Most of them come with all kinds of instructions, manuals, user groups, hotlines, etc. You don't have to put your ego on the line each time you forget how to call up a program or modify same for your particular problem. YOU ARE IN CHARGE! Just like your automobile and your TV, that micro is dependent upon you for its very existence and you call the shots. If you are resolving an n-array matrix, or playing Adventure, you don't have to twiddle your thumbs while some electronic time-sharing dictator decides which process to respond to.

To extend the library - computer comparison further, the librarian typically finds himself in the same unenviable position as does the computer system operator - that is, both control finite resources with more demands than the system can supply. Just as the computer system never has enough ports, or blocks, the library also can never hope to meet all of the informational needs of its user populace and hence winds up being just as unpopular with some users!

MICRO - MAIN FRAME: R/EVOLUTION IN PERSPECTIVE

While it is difficult to place so recent a phenomenon as microcomputers in historical perspective, it may be useful to consider some analogous technical innovations and their result.

An example that immediately comes to mind is that of transportation. For ages, man depended upon footpower and horsepower to get him from one point to another. The advent of the steam engine opened up new vistas with steamboats and railroads. The role of these movers of people and freight in developing the new continent is well documented, as are their pervasive sociological effects. More relevant to our present topic, however, is the development of personal transportation in the form of the automobile.

Despite any number of valid arguments as to the greater efficiency and lower cost of mass transportation, Americans fell in love with the car. Personal motorized transportation meant that (1) no longer was the individual at the mercy of some bureaucratic corporation in moving from point A to B; (2) each person now could own his transportation module; and (3) one's personal needs and habits didn't have to mesh with those of a large transportation network. The strong motivation towards personal transportation is even more remarkable in view of the cantankerous nature of the early machines, not to mention the absolutely deplorable state of the wagon roads they had to traverse! Parenthetically, we replaced the bureaucratic overlay of the mass transportation system with a whole new set of institutional arrangements to which we fell hostage, such as the auto salesman, repair man, finance company, the political bureaucracy concerned with licensing car and driver, traffic policemen, and so on ad infinitum!

I think the corollary with the personal computer is evident. For railroad or steamship line, substitute main frame computers, and for the automobile substitute microcomputer. I can't resist comparing the TRS-80 with the Model T! The pressures leading to the eventual demise of viable mass passenger transportation are the same as those which spell out the eventual obsolescence of the "big" computer.

Just one more comparison between autos and micros - even the names they bear may be significant. We just endured a whole generation of cars named after animals - mustangs, colts, panthers, and so on. Micro names are heavily oriented toward food - peanuts, apples, and so on. Perhaps the conclusion we should draw is that food is essential

for our very existence, while animals are merely added niceties! Even "microchips" has a gastronomical ring![1]

TECHNICAL CONSIDERATIONS

The mechanics of connecting a micro to a mainframe or mini are not that difficult. There are, of course, questions of interface protocols, types of ports, termcaps, and the like, but the solution to these is well documented. Were we to attempt to prescribe for even a significant portion of all of the possible configurations, this paper would wind up looking like the Boston phone book, and we would lose most of our audience.

More to the point, what are some of the reasons for making the connection? One of the impelling forces is the networking or intercommunication capability offered by existing large computer systems. These usually have tentacles (sorry, "ports") extending throughout an organization. In addition to the obvious advantages of electronic messaging, files can be transferred or shared and group interaction is facilitated. Also, there are obvious advantages in sharing expensive peripheral devices, such as high quality printers, plotters, and the like. Another important capability is the sharing of the wide variety of "utilities" (software) resident in most large mainframe/minis.

Let us consider these "advantages" in more detail to see if some option other than selling one's soul to IBM or DEC is available. We mentioned the large computer advantage in "networking". In scanning the literature of the field, one thing that jumps out at you is the current frantic research and implementation of microcomputer networks. Ethernet, Omninet (shades of 1984), Userlink, Multibus and literally dozens of siblings are springing up everywhere. The February issue of PC World advertises at least three such networks specifically for the IBM PC. The main bottleneck at the moment is Ma Bell; when this fiscal/technical problem is overcome, one of the most important advantages of the large computer will be eliminated.

Now let us look at the "sharing complicated and expensive software" argument. Depending upon your brand of micro, there is already a great deal of software available, much of it in the public domain. With a modem and the correct telephone number, one can dial up and download as much of it as you can handle. While some of this freeware is of admittedly poor quality, it will inevitably improve. When the point is reached where quality software that

addresses your needs is only a phone call away, yet another advantage of the big computers is nullified.

As far as sheer number crunching capability, it is only a matter of time until the quality micro can compete nicely. More than one Silicon Valley entrepeneur has the troops working on a "Vax on a chip", and similar projects, and, believe me, they will ultimately succeed! Cyber or Cray on a chip is, of course, another matter. However, it would be a serious mistake for the computer establishment to rely on large special purpose machines to bail them out. Just one of the new "super chips" (already available) is the Motorola 68000, which is described as being "perhaps the first microprocessor with an architecture and instruction set resembling that of a large mainframe"[2].

Another and telling argument in favor of the micro is the intense corporate involvement in micros by the mainframe dynasties, IBM, DEC and CDC. The name of the (future) game is decentralized workstations coupled by networks.

A final advantage of "established" computerdoms is that of inhouse expertise. Professor X or Vice President Y or Engineer Z doesn't want to learn how to program in FORTRAN or COBOL to solve his problems - instead, they greatly prefer to describe the problem to a computer professional and rely on said professional's expertise to produce a system relevant to their problem. As mentioned above, this may or may not work, and may or may not incur psychological damage! Yet even this final bastion of expertise will not prevent dramatic changes in computer land. One rapidly developing technology, a sort of synthesis of artificial intelligence[3] and heuristic systems is loosely termed "expert systems"[4]. An "expert system" is the computer equivalent of a knowledgable consultant. Such systems are already up and running in such diverse fields as geophysical exploration and medical diagnosis. They will be particularly potent in computer applications - you don't have to stand in line to use them, you incur little or no psychological costs in so doing, and, most importantly, they can synthesize and combine a much greater amount of expertise than could any one human being, and bring it to bear on your problems. Futuristic? Yes, but realizable, and <u>on the drawing boards</u>!

While we're at it, lets peer even deeper into the crystal ball and make yet another prediction that should give pause to the big computer world. Let's suppose that we connect our supermicros by the dozens, or even hundreds into a <u>loadsharing</u> network. Such systems are already

operational for big machines. At Purdue, our Engineering Computer Network connects a dozen or so VAX's into such a network. Those machines not being utilized to full capacity pick up part of the load of the busier machines. Back to the micros: on the infrequent occasions where more computing power is required than one machine can produce, as many additional micros as are needed are brought onto the network to handle the task. How many supermicros are needed to equal a Cyber? Not that many! Yet another current thrust in computer engineering is parallel systems and you can be sure that the results will be applied to micros!

MAINFRAMES, MINIS AND MICROS - PEACEFUL COEXISTENCE

Two case studies of micro integration worthy of our attention are Brown University and Carnegie Mellon. While both are still under development, they provide solid evidence of serious efforts to integrate the two breeds, while preserving the advantages of each.

Carnegie-Mellon is implementing a distributed computing system involving micros, mid-size "servers", and mainframes. The mainframes will continue to do the jobs for which they are best suited - handle large scale data bases, do complicated computing jobs involving large amounts of central processor capability, and provide archival storage. A number of local networks (LANs) will be created, each consisting of perhaps 50 micros, and these local networks will be tied to the mainframe/mini system by "servers", which are special purpose computers. Their timetable calls for deployment of the network to a 200-user community this year, expansion to 1,000 users by 1985, and, by 1986, provision of personal computers to all incoming freshmen.[5] Ultimately some 6,000 users will be served by the system.

Brown University's plan is sufficiently different to be of interest. Brown is planning a "scholar's workstation" for each member of their faculty, and, eventually, for each student. These will be organized into workstation networks, supported by the mainframe computers. This $50,000,000 development program will culminate in some 10,000 such stations, each being a "graphics-based computer with easy-to-use mouse-driven interfaces, and software designed by scholars for scholars."[6] (emphasis mine) By the end of the current academic year, they plan to have at least 150 to 200 such workstations installed and operational.

Both of these systems provide communication paths between users, as well as to the larger computers. The educational advantages seem obvious. The students can communicate conveniently between each other, and the professor can address the class individually, in groups, or collectively. The "electronic classroom" is becoming a reality!

Our situation at Purdue is probably more typical than not - until very recently, the attitude toward micros on campus was very negative (probably a defensive reaction based on the multimillions sunk into large computers!). Just within the last few months, however, the decision has been made to establish a "microcomputer laboratory" for undergraduates, with some 24 (!) machines, serving an undergraduate population of over 30,000 students.

CONCLUSIONS

From a user's viewpoint, it seems clear that micros are already profoundly altering the computing environment, and will do so to an even greater extent in the future. For the end user, it will be necessary to keep abreast of the latest developments and appraise their effects on his needs. For the computer professional, this constant re-education is not only necessary but will be vital to his survival in the field. End users probably have the edge in affecting the research/production/marketing strategies of the computer industry, since it is clear that these strategies are directly aimed at the growing segment of the populace that depend upon computers either professionally or casually. Computer professionals in that important group who are sandwiched between the computer manufacturers and the end users are particularly vulnerable to technological advances. Ironically, the frenzied burst of technological activity that created their jobs are now the major threat to them!

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